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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

GEYER, SCOTT B

ART UNIT

PAPER NUMBER

2829

DATE MAILED: 10/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/920,275	CHRYSLER ET AL.	
	Examiner	Art Unit	
	Scott B. Geyer	2829	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 07 January 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 28-30 is/are withdrawn from consideration
- 5) ☐ Claim(s) _____ is/are allowed
- 6) ☐ Claim(s) 1-27 is/are rejected
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on 12 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other _____

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-27, drawn to a semiconductor device, classified in class 257, subclass 675+.
- II. Claims 28-30, drawn to a method of making a plurality of dice, classified in class 438, subclass 105+.

The inventions are distinct, each from the other because of the following reasons:

1A. Inventions II and I are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the method claims recite severing of the diamond layer; the devices could have been made using deposited diamond layers, eliminating the need for a severing process.

1B. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

1C. Because these inventions are distinct for the reasons given above and the search required for Group II is not required for Group I, restriction for examination purposes as indicated is proper.

1D. During a telephone conversation (phone message) with Stephen De Klerk on September 11th, 2002 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-27. Affirmation of this election must be made by applicant in replying to this Office action. Claims 28-30 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

1E. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Drawings

- 2.** The drawings as submitted on 31 July 2001 are acceptable.

Specification

- 3.** The disclosure is objected to because of the following informalities:

Page 10, line 7: change "and" to - - an - -.

Appropriate correction is required.

Claim Objections

- 4.** Claims 3, 13, 17 and 20 are objected to because of the following informalities:

Claim 3: change "monocrystalline" to - - mono crystalline - -;

Claim 13: change "monocrystalline" to - - mono crystalline - -;

Claim 17 recites dependence to claim 11; should be dependent upon claim 12;

Claim 20: change "monocrystalline" to - - mono crystalline - -.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 19 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 19 recites a limitation wherein the die has a plurality of contacts on the integrated circuit and is located on top of the package substrate with the contacts at the bottom of the die. Since claim 19 does not specifically recite to what side of the integrated circuit is the "bottom", the examiner will assume the side with the contacts to be the side opposite the diamond layer.

7. Claim 24 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 24 recites a limitation wherein the layer of diamond is exposed. However, the claim fails to recite to what the diamond layer is exposed to. Without benefit of claiming to what the diamond layer is exposed to, the examiner will presume the diamond layer is exposed to the packaging encapsulant material and the lead pins of the package.

8. Claim 27 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 27 recites a limitation wherein the layer of

monocrystalline semiconductor material is **polysilicon**. It is not clear as to whether the applicant means silicon in polysilicon form or in monocrystalline form. For purposes of examination, the examiner will assume "polysilicon" to be "silicon".

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 1, 2 and 12 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Liu et al. (DIAMOND CHEMICAL VAPOR DEPOSITION Nucleation and Early Growth Stages).

As to ***independent claim 1***, Liu et al. teach layers of solid diamond deposited onto substrates and layers of diamond used as heat sinks for integrated circuits (see pages 4-7).

As to ***claim 2***, Liu et al. teach diamond deposition areas as large as 400 square centimeters and commercial production of free standing shapes of diamond greater than 100 square centimeters (see page 5).

As to ***independent claim 12***, Liu et al. teach layers of solid diamond deposited onto substrates and layers of diamond used as heat sinks for integrated circuits (see pages 4-7).

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11. Claim 8 is rejected under 35 U.S.C. 102(b) as being anticipated by Schrantz et al. (5,650,639).

As to **independent claim 8**, Schrantz et al. teach a layer of solid diamond 12 in figure 1E and a layer of monocrystalline semiconductor material 30 over the diamond layer.

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12. Claims 18-19 and 23-25 are rejected under 35 U.S.C. 102(b) as being anticipated by Nagy (5,696,665).

As to **independent claim 18**, Nagy teaches a package substrate in figure 2 wherein a die 11 is mounted in a package 10 and the die is also mounted on a diamond substrate 20.

As to **claim 19**, Nagy teaches an integrated circuit die 11, mounted in a package 10 wherein the contacts 12 are located opposite the diamond substrate 20.

As to **claim 23**, Nagy teaches a plurality of contacts 12 on the integrated circuit die, in figure 2.

As to **claim 24**, Nagy teaches the diamond substrate 20 exposed to the encapsulant material 90 and the lead pins 13.

As to **independent claim 25**, Nagy teaches an electronic device 10 that has a solid layer of diamond substrate 20 and an integrated circuit die 11 formed thereon.

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. Claims 3-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (DIAMOND CHEMICAL VAPOR DEPOSITION Nucleation and Early Growth Stages) as applied to claim 1 above, and further in view of Schrantz et al. (5,650,639).

As to **claim 3**, Liu et al. teach a layer of solid diamond on an integrated circuit as a heat sink material. Liu et al. does not specifically teach a layer of monocrystalline semiconductor material on which the layer of solid diamond is adjacent. However, Schrantz et al. teach a layer of monocrystalline semiconductor material 30 on a layer of diamond 12, in figure 1E (see also column 4, line 1 et seq.). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the device of Liu et al. with a semiconductor material of monocrystalline structure as taught by Schrantz et al. since the lattice structure of monocrystalline for the semiconductor is of better device quality.

As to **claim 4**, Liu et al. teach diamond deposition areas as large as 400 square centimeters and commercial production of free standing shapes of diamond greater than 100 square centimeters (see page 5).

As to **claim 5**, Schrantz et al. teach a monocrystalline semiconductor material, wherein the monocrystalline material is silicon (see column 4, line 1 et seq.).

As to **claim 6**, Schrantz et al. teach a layer of polysilicon deposited between the layer of diamond 12 and the layer of monocrystalline silicon (column 3, line 37 et seq.).

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15. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (DIAMOND CHEMICAL VAPOR DEPOSITION Nucleation and Early Growth Stages) as applied to claim 1 above, and further in view of Nagy (5,696,665).

As to **claim 7**, Liu et al. teach a layer of diamond used as a heat sink for an integrated circuit. Liu et al. does not specifically teach a plurality of contacts on the integrated circuit. However, Nagy teaches a diamond heat sink 20 attached to an integrated circuit die 11 in figure 2, wherein the integrated circuit die has a plurality of contacts 12. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the device of Liu et al. with an integrated device having contacts as taught by Nagy such that the integrated circuit device can be electrically connected to a board such as a printed circuit board or mother board.

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16. Claims 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schrantz et al. (5,650,639) as applied to claim 8 above, and further in view of Liu et al. (DIAMOND CHEMICAL VAPOR DEPOSITION Nucleation and Early Growth Stages).

As to **claim 9**, Schrantz et al. does not teach a layer of solid diamond at least 200 mm wide. However, Liu et al. teach diamond deposition areas as large as 400 square centimeters and commercial production of free standing shapes of diamond greater than 100 square centimeters (see page 5). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the device of Schrantz et al. with a layer of diamond at least 200 mm wide as taught by Liu et al.

since a manufacturing process would be more efficient in coating a large wafer first rather than coating individual die from the wafer.

As to **claim 10**, Liu et al. teach diamond deposition areas as large as 400 square centimeters and commercial production of free standing shapes of diamond greater than 100 square centimeters (see page 5). Therefore, the substrate must be as large as the coating area of the diamond.

As to **claim 11**, Schrantz et al. teach a monocrystalline semiconductor material, wherein the monocrystalline material is silicon (see column 4, line 1 et seq.).

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17. Claims 13-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (DIAMOND CHEMICAL VAPOR DEPOSITION Nucleation and Early Growth Stages) as applied to claim 12 above, and further in view of Schrantz et al. (5,650,639).

As to **claim 13**, Liu et al. teach a layer of solid diamond on an integrated circuit as a heat sink material. Liu et al. does not specifically teach a layer of monocrystalline semiconductor material on which the layer of solid diamond is adjacent. However, Schrantz et al. teach a layer of monocrystalline semiconductor material 30 on a layer of diamond 12, in figure 1E (see also column 4, line 1 et seq.). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the device of Liu et al. with a semiconductor material of monocrystalline structure as taught by Schrantz et al. since the lattice structure of monocrystalline for the semiconductor is of better device quality.

As to **claim 14**, Schrantz et al. teach a monocrystalline semiconductor material, wherein the monocrystalline material is silicon (see column 4, line 1 et seq.).

As to **claim 15**, Schrantz et al. teach a layer of polysilicon deposited between the layer of diamond 12 and the layer of monocrystalline silicon (column 3, line 37 et seq.).

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18. Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (DIAMOND CHEMICAL VAPOR DEPOSITION Nucleation and Early Growth Stages) as applied to claim 12 above, and further in view of Nagy (5,696,665).

As to **claim 16**, Liu et al. teach a layer of diamond used as a heat sink for an integrated circuit. Liu et al. does not specifically teach a plurality of contacts on the integrated circuit. However, Nagy teaches a diamond heat sink 20 attached to an integrated circuit die 11 in figure 2, wherein the integrated circuit die has a plurality of contacts 12. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the device of Liu et al. with an integrated device having contacts as taught by Nagy such that the integrated circuit device can be electrically connected to a board such as a printed circuit board or mother board.

As to **claim 17**, Nagy teaches an integrated circuit die which has a rectangular outline when viewed from above, as can be plainly seen in figure 2.

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Art Unit: 2829

19. Claims 20-22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nagy (5,696,665) as applied to claim 18 above, and further in view of Schrantz et al. (5,650,639).

As to **claim 20**, Nagy teaches a package substrate in figure 2 wherein a die 11 is mounted in a package 10 and the die is also mounted on a diamond substrate 20. Nagy does not teach a layer of monocrystalline semiconductor material on which the layer of solid diamond is adjacent. However, Schrantz et al. teach a layer of monocrystalline semiconductor material 30 on a layer of diamond 12, in figure 1E (see also column 4, line 1 et seq.). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the device of Liu et al. with a semiconductor material of monocrystalline structure as taught by Schrantz et al. since the lattice structure of monocrystalline for the semiconductor is of better device quality.

As to **claim 21**, Schrantz et al. teach a monocrystalline semiconductor material, wherein the monocrystalline material is silicon (see column 4, line 1 et seq.).

As to **claim 22**, Schrantz et al. teach a layer of polysilicon deposited between the layer of diamond 12 and the layer of monocrystalline silicon (column 3, line 37 et seq.).

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20. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagy (5,696,665) as applied to claim 25 above, and further in view of Schrantz et al. (5,650,639).

As to **claim 26**, Nagy teaches a package substrate in figure 2 wherein a die 11 is mounted in a package 10 and the die is also mounted on a diamond substrate 20. The

- Art Unit: 2829

integrated circuitry is on top of the die 11 and the diamond 20 is below the die 11. Nagy does not teach a layer of monocrystalline semiconductor material on which the layer of solid diamond is adjacent. However, Schrantz et al. teach a layer of monocrystalline semiconductor material 30 on a layer of diamond 12, in figure 1E (see also column 4, line 1 et seq.). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the device of Liu et al. with a semiconductor material of monocrystalline structure as taught by Schrantz et al. since the lattice structure of monocrystalline for the semiconductor is of better device quality.

As to **claim 27**, Schrantz et al. teach a layer of polysilicon deposited between the layer of diamond 12 and the layer of monocrystalline silicon (column 3, line 37 et seq.).

Conclusion

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott B. Geyer whose telephone number is (703) 306-5866. The examiner can normally be reached on weekdays, between 10:00am - 6:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael J. Sherry can be reached on (703) 308-1680. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Art Unit: 2829

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

S.B.G.
September 30, 2002

A handwritten signature in black ink, appearing to read "M. Sherry", with the date "9/30/02" written below it.

MICHAEL SHERRY
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800